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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09 603,459	06 22 2000	Masahiro Watanabe	16869P-010300US	9583

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TOWNSEND AND TOWNSEND AND CREW, LLP
TWO EMBARCADERO CENTER
EIGHTH FLOOR
SAN FRANCISCO, CA 94111-3834

EXAMINER

VANORE, DAVID A

ART UNIT PAPER NUMBER

2881

DATE MAILED: 03 13 2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/603,459

Applicant(s)

WATANABE ET AL

Examiner

David A Vanore

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE ____ MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-35 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☐ Claim(s) 1-3, 5, 8, 10-15, 17, 18, 20-22 and 26-33 is/are rejected.
- 7) ☐ Claim(s) 4, 6, 7, 9, 16, 19, 23-25, 34 and 35 is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on 22 June 2000 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on ____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. ____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 4.

- 4) ☐ Interview Summary (PTO-413) Paper No(s) ____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: ____.

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DETAILED ACTION

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claim 20 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The term "high" in claim 20 is a relative term, which renders the claim indefinite. The term "high" is not defined by the claim, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention. The specification or claim should indicate how rapidly the focal point is changed and what this changes translates to in terms of beam scanning speed on the sample.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-3, 5, 8, 10, 11-15, 17-18, 20-22, and 26-33 are rejected under 35

U.S.C. 102(b) as being clearly anticipated by Hattori et al.

Hattori et al. teaches a charged particle beam lithographic apparatus and associated method of use comprising the following as recited in claims 1-3, 8, 10, 11-15 26-31:

- 1) A stage for holding a sample (11)
- 2) A charged particle optical system for converging a charged particle beam on a sample (20) having a source (21).
- 3) A beam scanning means (25 and 26)
- 4) A focal point control system (Col. 6 Line 26-29)
- 5) An astigmatism adjustment means (28).
- 6) A sample image detection means (37).
- 7) An image processing means for computing the dimensions of an image, astigmatism of a beam, and focal offset of a beam on the basis of a detected two dimensional image (44) for a plurality of detected images (Col. 7 Line 60 – Col. 8 Line 23).
- 8) A computer control means (30) for adjusting the focal point and astigmatism based on feedback information generated from a detected image where the feedback information comprises image data on a detected focus value and astigmatism value (Col. 6 Line 64 – Col. 9 Line 15) where the beam edge resolution is measured and computed in four directions and used to correct a focus value and astigmatism value in those four directions (Col. 2 Line 43-Col. 4 Line 55) such that the astigmatism is reduced to a minimized value as recited in claim 30.

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Regarding claim 17 which recites "wherein said particle image detection means has a configuration wherein a particle image having a plurality of different focal point positions is detected by controlling said focal point control means", the limitation of this claim can be distilled to mean that a particle image is detected by controlling the focal point control means. This limitation is taught by Hattori et al. on Col. 8 Lines 37-60. Hattori et al. teaches that the initial focus condition is set, backscattered electrons are detected, and the focus condition is altered in response to the analyzed signal. The backscattered electron signal is what the image processing means (44) uses to synthesize a sample image.

Regarding claim 18, which recites that a particle image is detected from a plurality of different areas on the sample, Hattori et al. teaches that the beam is scanned across the sample (Col. 7 Lines 60-68) and that the backscattered electrons are detected subsequent to this scanning procedure. This anticipates claim 18.

Regarding claims 21, 22, 32, and 33, Hattori et al. teaches finding maximum values for beam directional sharpness magnitudes (resolution), and applies a Gaussian function to determine the peak of these functions where the peaks are treated as in focus positions (fig. 5). Further, since Hattori et al. shows that a plurality of peaks exist, Hattori et al. goes on to teach taking an average of these positions to determine an in focus position (Fig. 7 and Fig. 9 a3).

Allowable Subject Matter

Claims 4, 6, 7, 9, 16, 19, 23, objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is a statement of reasons for the indication of allowable subject matter:

The prior art of record fails to teach an apparatus which computes and corrects a focal offset and astigmatism based on a two dimensional image of a particle image where the pattern is divided into at least three areas, each of the areas having an edge component in one of the three directions on the sample and consisting of a subpattern as recited in claim 4.

The prior art fails to disclose a charged particle lithography apparatus which corrects an astigmatism and beam focus on the basis of a detected two dimensional image of a sample and further comprises a defect inspection image processing means as recited in claim 6. Claims 7 and 9 are indicated as allowable and are objected to because the prior art fails to suggest or teach the device cited above in reference to claims 1 and 6, the device further comprising a focal point control system having a sample height measurement sensor.

The prior art fails to teach or suggest a charged particle lithography apparatus which corrects an astigmatism and beam focus on the basis of a detected two dimensional image of a sample and determines the directional sharpness of an image in

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at least three directions using Fourier Spectrum analysis of a detected image as recited in claim 16.

The prior art fails to teach or suggest a charged particle lithography apparatus which corrects an astigmatism and beam focus on the basis of a detected two dimensional image of a sample where the sample is inclined or has a staircase like structure as recited in claim 19.

The prior art fails to teach or suggest a charged particle lithography apparatus which corrects an astigmatism and beam focus on the basis of a detected two dimensional image of a sample where the image processing means determines an in focus position for each of the directional sharpness magnitudes as a center of gravity of an area enclosed by a segment of a curve and a horizontal line representing a threshold value where said curve represents variations of each of said directional sharpness magnitudes with respect to an in focus position as recited in claims 23, 24, 34, and 35.

The prior art fails to teach or suggest a charged particle lithography apparatus which corrects an astigmatism and beam focus on the basis of a detected two dimensional image of a sample where a calibration substrate is provided along with an object substrate where the astigmatism or focal point correction takes place prior to observation of the object substrate as recited in claim 25.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

The following US Patent documents disclose charged particle devices which correct astigmatism as a function of beam focus. Of particular note are the Yamada et al. and Ogasawara et al. references.

US Patent 5,391,886 (Yamada et al.); US Patent 5,396,077 (Sohda et al.);

US Patent 5,302,829 (Komatsu et al.); US Patent 5,627,373 (Keese);

US Patent 5,793,041 (Ogasawara et al.); US Patent 5,656,812 (Takahashi);

US Patent 5,502,306 (Meisburger et al.); US Patent 5,313,062 (Yamada);


US Patent 5,144,129 (Kobayashi et al.); and US Patent 4,737,640 (Ohashi);

Any inquiry concerning this communication or earlier communications from the examiner should be directed to David A Vanore whose telephone number is 703-306-0246. The examiner can normally be reached on M-F 7:30-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John Lee can be reached on 703-308-4116. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9318 for regular communications and 703-872-9319 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

February 27, 2003


JOHN R. LEE
SUPERVISOR PATENT EXAMINER
TECHNOLOGY CENTER 2800